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From the Author

A LETTER

ON

BRANCH RAILWAYS

ADDRESSED TO

THE RIGHT HONOURABLE

LORD STANLEY OF ALDERLEY,

President of the Board of Trade,

&c., &c., &c.

[illegible]

CONTAINING SUGGESTIONS FOR THE CREATION OF A SYSTEM OF SECONDARY RAILWAYS FOR THE AGRICULTURAL DISTRICTS.

BY

EDMUND SHARPE, M. A.,

Fellow of the Royal Institute of British Architects.

WITH AN APPENDIX AND MAP.

London:
SIMPKIN, MARSHALL, & Co., PATERNOSTER ROW.

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TO THE RIGHT HONOURABLE

LORD STANLEY OF ALDERLEY,

&c., &c., &c.

My Lord,

I venture to address the following remarks to your Lordship, upon a subject in which, as coming within the cognizance of the Board of Trade, you may naturally be supposed to take an interest, in the hope, that, if the necessity for an alteration in the law, as regards Railways of the nature herein referred to, be made apparent, your Lordship's co-operation will not be wanting in support of any efforts, that may hereafter be made, to remove the disabilities and evils complained of.

It is not difficult to imagine the astonishment with which an Engineer of the last century, were he permitted to revisit the earth, would view the gigantic public works, which have covered the face of this country during the last five and twenty years. Nor would his surprise, at first sight, be lessened on discovering, that the whole of these numerous and costly works of earth, stone, timber, and iron, were constructed in order that a pair of narrow iron bars might be carried continuously, as nearly as possible level and in a straight line, exactly four feet eight inches and a half apart. If, however, he were told, that it is possible for a horse to draw, in a carriage adapted to these iron bars, eight times the load, that he can upon an ordinary high road, his astonishment would rapidly diminish; and if he were further informed, that an engine has been invented capable of drawing fifty such eight-horse loads, at a speed of forty miles an hour, on this iron road, it would almost altogether disappear. One circumstance would alone remain to puzzle his mind; he would be at a loss to discover why the whole of these iron rails should, with certain exceptions, be laid exactly four feet eight inches and a half apart—neither more nor less. Nor would the solution of this question be rendered easier to him were he to learn the fact, that this width, or guage, of the iron road has been fixed and determined by legislative authority; and that a special enactment has provided that, with certain specified exceptions, all such public Railways for the conveyance of goods and passengers shall be constructed with this guage, and no other.*

It is to the injurious operation of this and other similar Parliamentary restrictions on the industry and enterprise of all those districts, which do not lie upon a Main Line of Railway, that attention is principally intended to be drawn in the following remarks.

Of the two great discoveries already alluded to, upon which the system of Railway Locomotion is based, the first mentioned is undoubtedly the most important. Without the *facility of traction,* afforded by the use of a carriage with *flanged wheels on parallel iron rails*, the Locomotive would be, and indeed has been proved to be, a comparatively useless machine. The persevering efforts which have been made, since the Manchester and Liverpool Railway was first opened, to adapt the Steam-horse to the high road, have uniformly ended in disappointment;* and although in Boydell's Traction Engine the attempt has been successfully made to cause a locomotive to traverse, not only the high road, but the open country, yet the success is due to the circumstance, that this engine, with its flanged wheels, *carries with it its own Railway,* laying it down, and taking it up, as it proceeds.

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* 9 and 10 Victoria, cap. 57.

Power and speed the Locomotive has brought to the rail; and economy also, where heavy loads are carried long distances; but the saving effected by it in the cost of the transit of goods under ordinary circumstances, is, owing to the costly machinery necessary for its use, after all, trifling, compared with the saving already previously effected by the rail and the flanged wheel combined.

As this fact has an important bearing upon the matter in hand, it may be well, in the first instance, to consider the relative cost of conveying a Ton of

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* The last attempt of the kind, and not the least interesting, is that which has recently been made by Lord Willoughby d'Eresby, on a private road four miles in length, leading from the village of Edenham in Lincolnshire to the Little Bytham Station, on the Great Northern Railway. In this case a solid roadway was formed of two parallel lines of contiguous wooden blocks laid level with the surface of the road, on which it was attempted to work a very perfect small 8-inch cylindered locomotive with flat wheels, built at the Swindon works. The experiment, which was in every respect well carried out, and is worthy of record, removed the last existing doubt upon the subject; it was ultimately found necessary to place iron rails upon this solid block-road, and the Edenham Tramway, liberally designed for the benefit of the tenants of the Grimsthorpe estate, is now converted into a Railway of the usual guage, and worked by a locomotive and carriages with flanged wheels.

Goods one mile; I. on an ordinary high road; II. on the rail by horse power; and III. on the rail by locomotive; this may simply be stated as follows:—

On High Road by Horse	8d.
On Railway by Horse	2d.
On Railway by Locomotive	1d. *

Now the disadvantages under which all those towns and districts lie, that are not so fortunate as to be within easy distance of a siding or Station on one of the Main Lines of railway, are due to the circumstance, that they have, on the above shewing, to pay *eight times as much* for the carriage of a ton of produce or goods for every mile of the distance which separates them from that Station, as they have to pay for its carriage when once upon the Line: and the grievance of which they have to complain, is, that the Standing Orders and requirements of the Houses of Parliament are such as not only to render any lateral extension of the Main Line for their limited traffic utterly hopeless, but also to deprive them of that simple and inexpensive substitute, which would otherwise be within their reach, and which would place them on more equal terms with their more fortunate neighbours.

This, then, is the grievance; but before we proceed to speak of a remedy, let us consider its effects.

The natural result of our limited Railway system, already for some time in operation, is perceptible over the whole kingdom, in the rapid and considerable improvement in the value of land and houses in the neighbourhood of railways; in the increase of habitations and population in their immediate vicinity; in the gradual decay of the remoter towns and villages; in the deterioration of the high roads and means of communication; in the abandonment of small trades, manufactures, and handicrafts in these less accessible parts, and in the consequent increase of vice and crime. It will be readily believed, that with such self-evident results, efforts were not wanting, on the completion of the main lines of communicaton, to push the system into every outlying lateral district, the amount of the traffic in which afforded the slightest justification for the attempt. Nor did these efforts on the part of those interested in obtaining these facilities of communication remain unseconded; it is not to be supposed, that those who had profited so largely by the construction of the Main Line were unwilling to promote the Branch; the officials of the parent trunk were generally the sponsors of the offshoot; and in this way numerous Branch lines, designed after the model of the original standard, were brought before the public, and carried into execution. Of these minor projects it may, with safety, be affirmed, that few have proved to be other than unprofitable undertakings, and the greater part of them absolutely disastrous to the shareholders, or to the unfortunate parent company which was induced to originate or adopt them; and the lamentable error committed by the Boards of the older Railway Companies, in the purchase and construction of these Branch Railways, is recognized as one of the principal causes of the subsequent decline in the value of Railway property.

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* These prices cover all costs and charges including those of maintenance, and interest on first cost.

It is not meant here to be asserted that the lateral extension of an ordinary first class locomotive Railway is in no case justifiable; two conditions are, however, absolutely essential to its success as a commercial undertaking: the first relates to the nature of the country, through which it is to pass, and the second to the amount of its traffic; and both may be combined in the following axiom:—*the facilities for constructing the Railway must be such, that the proceeds of the future traffic shall be equal to twice the amount of the interest of the capital required.*

To illustrate this position, we will take the case of a town lying at a distance of ten miles from a Main Line of railway; and we will suppose the facilities for constructing the Branch to be so great, that the sum of £70,000 only is required to complete a single line of railway, to construct the stations, goods sheds, signals, &c., and to provide the plant, and every other necessary. Then, reckoning the interest on £70,000—the dividend that the shareholders will expect—at 5 per cent., that is to say, at £3,500 per anunm, and taking the working expenses of the line at the usual, and in this case, favourable rate of 50 per cent on the receipts, £7,000 per annum is the sum which the traffic ought to produce to pay. working expenses, and the required dividend; and if we divide this sum in the proportion that the existing goods and passenger traffic bear to one another, we shall have a result which will guide us to a correct judgment. Suppose, for example, that the goods traffic is to the passenger traffic as 3 to 2, then reckoning the goods to pay altogether 2d. per ton per mile, and passengers to pay an average rate of 2d. per head per mile, it will require a Goods traffic of 50,400 tons per annum, or 138 tons per diem carried along the whole line, and a passenger traffic of 33,600 persons per annum, or 92 persons per diem carried the same distance to realize the above sum, and to render the undertaking commercially justifiable:* and if to the existing traffic a not unreasonable addition be made, as due to the creative power of the Railway system, a comparison of the two results will lead to safe conclusions.

Had this simple test been honestly applied to the various districts, in which first class Branch lines have been laid down, two thirds of them would never have been constructed; and we may safely conclude that there is not a district in the kingdom, hitherto unexplored by those interested in the promotion of these undertakings, in which the application of this test would produce a favourable result. If indeed there were such a district still left, it would be difficult for the usual promoters of such undertakings to induce the public to believe it, and with the experience of the past to advance the capital necessary for its relief: and to hope that the shareholders in any of the existing lines will ever sanction such attempts on their own account, or, at any future time, consent to the application of their corporate funds in the construction or purchase of such extensions of their Main Line, is utterly vain and illusory.

Of the extent of country which is thus excluded from the benefits of cheap locomotion,

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* Goods.	50,400 Tons	@	2d.	×	10 Miles	= £4,200.
Passengers	33,600	@	2d.	×	10 Miles	= £2,800
	84,000					£7,000

an idea may be formed, by marking out on the Map of the United Kingdom a breadth of three miles on each side of the existing lines of Railway, and comparing the extent of land thus covered with that which remains. The magnitude of the interests involved in a solution of the problem will at once be apparent.

The well ascertained fact, already referred to, that a horse can draw eight times as much on a pair of rails as he can on an ordinary macadamized road, leaves us little room to doubt, that it is to the iron rail and the flanged wheel, that the remoter agricultural districts must look for those facilities of communication, which are to put them on equal terms with the rest of the world. This determined, the form of the rail, the width and nature of the roadway, and the means of propulsion remain to be considered.

If all districts were alike in the nature and amount of their produce and traffic, it would be easy to prescribe at once the form and character of these secondary railways. They may, however, generally be divided into two classes; namely, those on which locomotive assistance will at once, or may shortly hereafter, be required, and those in which it will not. It is evident, that this is a condition, which materially affects the nature of the roadway, and the cost of the work ; it is desirable, however, that the two systems be laid down in such a manner, that the one shall be easily convertible into the other, when increased traffic and the circumstances of the case require it.

We shall thus have two classes of Secondary Railways, the FIRST CLASS TRAMWAY, as it may, for the sake of distinction, be called, worked either partially or altogether by Locomotive power; and the SECOND-CLASS TRAMWAY, worked by horse power; both differing essentially from the ordinary Parliamentary First-Class Railway at present in use.

GUAGE.

It is needless to enquire into the circumstances that fixed the Guage of the Manchester and Liverpool Railway at the remarkable measure of feet inches and fraction of an inch, which is neither the multiple nor the aliquot part of any known dimension. It is sufficient for the unlearned in such matters to know, that the adoption of four feet eight inches and a half as the width between the rails of that Railway, necessarily repeated in the branches and extensions of that undertaking, and subsequently adopted by the legislature, as the guage on which the whole of the extensive system, of which that Railway, in its enlarged dimensions, may be said to be the centre, was the result of accident and not of design.* To speculate, at the present day, however, on the superior practical advantages of any other guage as applicable to this system, were equally idle; it is self-evident that all *continuous* extensions of this system, for the carriage of *through* traffic, must be designed on the model of the original; and we have reason to be thankful for that act of the legislature, which defined and limited all departures from this standard measure in the Main Lines of the kingdom.

This remark, however, does not apply to such lateral and limited extensions of the Railway system as those at present under discussion. The Main Lines of the kingdom are all constructed, the Branches—the feeders of the parent system—principally remain to be added. An exception must be made in favour of these smaller undertakings, or Railway extension is at an end. To refuse to the remoter districts and out-lying towns the minor facilities within their reach, which will sufficiently serve their purpose, is to prohibit to them the advantages, which the legislature has accorded on a larger scale to their wealthier and more prosperous neighbours. To continue to do so were equally impolitic and unjust to existing railway companies as to the interests in question. The Railway system, as it stands at present, is limited, exceptional, incomplete. The trunk of the tree is fully developed, but the boughs are wanting: the back-bone is there, but the ribs remain to be added before the skeleton of the structure can be said to be complete: the larger arteries exist, but it is by the smaller blood vessels, that fresh vigour and healthy action is to be infused into the whole system. No such system can, in other words, be said to be complete, which does not possess its minor channels of communication, its tributaries and feeders, diverging from the main channel on each side, spreading and ramifying in every direction; drawing produce and carrying traffic into and out of every town, village, hamlet, and homestead within its reach. This is what the Railway system must become, or it will fall short of its mission. This is, however, what it will never become until these tributary lines are permitted to bear, in the size and extent of their works, the same relation to the principal lines, that, in other similar systems, the branches bear to the main trunk.

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* Those who desire to investigate the causes of this accident will find them detailed in *Smiles Biography* of George Stephenson, p. 196.

The first privilege, then, to be accorded to the promoters of these Secondary Railways is, that they shall be at liberty, in the construction of their lines, to adopt a guage other than that of the Main Lines. This is not a matter of slight moment: the question involved is not that of the purchase of a few yards of land, more or less; every item of cost is affected by the increase of the width of the Railway. The weight of the rail, the strength of the sleeper, the depth of the ballast, the breadth and contents of the cuttings and embankments, the width and strength of the bridges and culverts, and, lastly, the size and weight of the rolling stock, are all increased by every inch that is added to the width of the permanent way, and are, in like manner, diminished by its reduction. The narrow mineral railways of two-foot guage and upwards, existing in different parts of the kingdom, and costing from £800 to £1,200 per mile, illustrate the extent to which this reduction, dependent principally upon width of guage, may be carried.

It is not absolutely necessary that these Secondary Railways should all be of one guage, but for the sake of uniformity, and consequent economy in the construction of the rolling stock, and other necessary appliances, it is, on the whole, desirable that they should be so. The guage, then, should be such as, without increasing too greatly the cost of construction, will admit of the use of locomotive engines and passenger carriages of sufficient breadth. Three feet would appear to be a width, which, intermediate, as as it is, between that of the mineral tramway of two feet, and that of the ordinary First Class Railway of four feet eight inches and a half, would meet both these requirements, and be in other respects a suitable one for the purpose; and it is upon consideration, and not without a certain practical experience in the matter, that I venture to recommend this guage as the one to be adopted for the whole of these Secondary Railways.

To the adoption of any guage, other than that of four feet eight inches and a half, an objection is likely to be urged, which it may be well here to to notice and to meet. It may be said, that the cost of unloading and reloading the goods from the smaller waggon into the larger one, at the point of junction with the Main Line, is an additional tax upon the Secondary Railway, which, were the guage of both lines the same, it would not have to bear. This objection is valid, in regard to goods only, to a certain extent; in regard to passengers it is certain, that, in either case, they would have to change carriages at the point of junction; this being the universal practice, on all Branch Lines of ordinary guage, at the present time. In respect to goods it would be valid only where the cost of thus transferring the traffic counterbalanced the interest on the saving realised in the construction of a cheaper line. Now the cost of transferring coals and lime from a railway truck into carts at the different stations is rendered, by an arrangement that must be familiar to all, absolutely trifling; and there is no reason why the same arrangement should not be adopted for the waggons of a Tramway for all similar materials. Blocks of stone or marble, flags, timber, sacks of grain, packed goods, and bales of all kinds are transferred by a crane with the greatest ease. There would still remain a portion of the traffic that could only be moved by manual labour; but an average charge of three pence per ton for all descriptions of goods would amply cover the amount of this tax. This objection can, therefore, at best, only apply to Branch lines not exceeding three or four miles in length, if any such, to supply a district so entirely within what may be called the marginal limits, or reasonable reach of the Main Line itself, be at any time required. But, beside the sufficient answer here given, there is another of a much more fatal and insuperable nature. Even if the Branch Line were so constructed as to admit of the trucks of the Main Line passing over it, it is on all accounts undesirable that they should do so ; or rather, that the smaller company should be thus dependent, for the accommodation of its traffic, on the larger one. The complications that daily arise on the Main Lines, sufficiently prove the inexpediency of this arrangement. Few of the larger companies have waggon stock sufficient for their own purposes; and when the pressure arising from this deficiency begins to arise, it is the traffic of the Branch, which is the first to feel it. Neither, on the other hand, is it desirable that the waggons of the Branch should be sent on the Main Line. The moderate stock that would be sufficient to work the traffic on a ten or fifteen-mile railway from end to end, would be totally insufficient to send that traffic to a distance. When a truck shall once have left the line, the time of its return would be a matter of most uncertain calculation; and to burthen the Branch with the large amount of expensive stock, that would in this case become necessary, would be to defeat the object proposed to be accomplished. Lastly the handling of the light stock of a three-foot Railway at each terminus would be easy and inexpensive; the strength of a man is equal to the moving of a three-ton truck; horse-power is requisite to shunt one of six or eight tons. These considerations appear to offer an unanswerable reply to the natural objection founded on the break of guage; the interests of the Branch would, in fact, demand that the break should occur, *whether the guage were the same or not.*

CURVES AND GRADIENTS.

The next point, in respect to which the indulgence of Parliament will be required, relates to the Curves and Gradients. In laying out the Main Lines not much care was taken to adjust the Line to the nature of the ground; the "straight-edge" of the engineer was applied to the plan and section; the tangential straight line was laid down upon the one, and the "ruling gradient" upon the other, and thousands of pounds were ruled off with a stroke of the pencil; the principal care taken was to see that the cuttings were sufficient to fill the embankments; the cost of the work was a subordinate consideration. Nor indeed with the heavy weights now carried, and the speed attained upon the Main Lines, would sharper curves or more frequent changes of gradient be admissible. This, however, is not the way, in which our future Branch Lines are to be laid out, if they are to be of the useful and inexpensive character sought for. All heavy works of every kind must be absolutely avoided. They must be as nearly "surface lines" as it is possible to make them. Every care must be taken to adapt the line to the undulations of the ground, both lateral and vertical; the longer route by the flat valley must be taken, in preference to the shorter cut through the hill; no curve must be considered too sharp, round which the traffic can be worked with ease at a reduced speed; no change of gradient too frequent, whereby the amount of cutting and embankment may be reduced. Steep gradients must, however, be avoided; it were better, as well for convenience of working, as for cheapness of construction, where the rise of ground from end to end of the line is considerable, to concentrate the difficulties of the ascent in one or two self-acting inclined planes, than to spread them over the whole line: or, where a steep summit has to be surmounted, to adopt the plan of zigzag inclines, in use in America, and recommended by Captain Galton in his Report on American Railways.*

LEVEL CROSSINGS.

With respect to Level Crossings there cannot be much difficulty. When the greater speed of the trains, and the more frequent interuptions to the road traffic, occasioned by the level crossings on the existing Lines of Railway, are taken into consideration, it can hardly be contended that a privilege, which has been accorded so extensively to the Main Lines, should be refused to the Branches, in any case where a level crossing is practicable.

Nor should the right of carrying the railway along, as well as across, existing roads, or the streets of a town, on the level, be denied, where the public convenience may be best served in this manner. "The encouragement of the use of rails on roads and streets to facilitate the distribution of goods traffic, as well as to accommodate local passenger traffic," is a course recommended by Captain Galton in the Report already referred to, in towns where the streets will admit of it, and favourably contrasted by him with that of "throwing every impediment in the way of thus extending the advantages of Railways."*

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* Report to the Board of Trade on the Railways of the United States by Captain Douglas Galton, R. E., p. 26.

And here it may be proper to notice a suggestion, which has more than once been made, that, in the construction of these subsidiary railways, advantage should be taken of the existing high roads; and, that, in order to avoid the serious expenses attendant upon an Act of Parliament, and the purchase of land by compulsory powers, the rails should be laid, by arrangement with the Trustees or owners of such a road, on the highway itself. To this course there are several serious objections. In the first place, the nature and position of the existing Road Trusts in the kingdom are such, and the difficulty of obtaining the united assent of Trustees to such a proposition, and of rendering such assent, if obtained, valid and permanent, would, in all probability, be so great, as to destroy all hope of the possibility of the general adoption of such a measure, were it in other respects practicable or desirable. In the second place, it is obvious, that such railways could never be worked by locomotive power, and separated or fenced off from the remainder of the highway; and that they would only be available for horse power, and be therefore of the kind, which I have called Second Class Tramways. It may, however, be urged, that, for the latter purpose, and until greater accommodation become necessary, they may answer well enough; but, lastly, the principal objection to this proposition is one, that is derived from a consideration of the nature of the advantage, which the rail offers over the high road. Whatever be the relative tractive power of the horse on the rail, and on the road, *when both are on the level,* it is certain that the proportion of the one to the other diminishes rapidly as the roads are inclined; the steeper the gradient—the more the load hangs on the horse—and the less the advantage of the rail over the road. The accidental occurrence, therefore, of two or three steep ascents on a high road, affecting, as they would, the weight of the load carried along its entire length, would be sufficient greatly to diminish, (if, considering the cost of the additional work, it did not entirely annihilate) the superior value of the railway over the high road. Now it is confidently believed, that there are very few high roads in the kingdom, on which frequent defects of this kind do not occur; and still fewer, leading from one given point to another, between which a superior line, in respect to levels, curves, and gradients, might not be obtained; and it would be unfortunate if the demand for increased facilities of communication to the agricultural districts, which is now beginning to be urged with so much force, were to be met and complied with in a manner, which, presumed to be the readiest, but admitted not to be the best, might lead to a loss of more than half the full value of the boon.

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* Report, p 26.

STATIONS AND SIDINGS.

As these Tramways are for use, and not for show, the simpler and less pretending the stations are, and the better; shelter for passengers, a small goods shed, and a clerk's office, are all that the service will require. Passengers tickets may be issued and collected by the conductor of the train. Constructed, however, as they will be, for the use and benefit of the district, it is important that landowners and manufacturers, possessing property or works within reach of the Railway, should be allowed facilities, in regard to sidings, which are inadmissible on the Main Lines. There is no reason, indeed, why extensions of this three-foot Tramway should not be carried into every quarry, mine, factory, or farm-yard of the valley or district along which the Line runs; nor why each large farmer and occupier should not have his two or three trucks, carrying off his produce, and bringing back his coal, and lime,* and manure, loaded and discharged on his own premises, by his own men, and under his own eye, and sent to his own siding to swell the train, as it passes down the Branch to the junction on the Main Line: nor why the quarry-master, the lime-burner, and the slate-owner should not have equal facilities for the despatch of their traffic, and for the development of the sources of industry, of which they may happen to be possessed.

RAILS.

The description of Rail best adapted to the requirements of these Secondary Railways appears to be one resembling that, which is known as the "contractor's rail;" an elliptical-headed rail, with a narrow neck, and flat bottom flange, spiked to transverse wooden sleepers, and fished at the joint. The absence of chairs, and the ease with which such a roadway can be laid and repaired, are reasons in favour of its adoption in a case where simplicity and economy are of paramount importance. A rail of 35 lbs. per lineal yard, for First Class Tramways, and of 25 lbs per yard, for Second Class Tramways, will be found sufficiently strong and durable for the traffic in question.

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* There is no doubt that there are immense tracts of land in the kingdom, now lying comparatively waste, which, by the introduction of lime at a cheap rate of carriage, might be brought into profitable cultivation.

ROLLING STOCK.

The Rolling Stock of these Secondary Railways will manifestly be of a character very different from that of the Main Lines: there is no doubt that their utility, and the economical efficiency of the service on them will depend much upon the manner in which the design of the carrying stock is adapted, as well to the exigencies of the traffic, as to the nature of the roadway. Opportunity will be afforded for the introduction of a principle not hitherto much attended to on the Main Lines, the reduction, namely, of the dead weight in passenger carriages, as compared with the living freight, and of the unprofitable load, in the goods waggons, as compared with the profitable load. The union of lightness and strength in the plant of these smaller lines will, for many reasons, be a matter of importance. Convenience of handling, will be, from the limited power available, as well at the termini, as at each road-side station or siding, absolutely essential.

The employment of small Locomotives upon several of the narrow guage mineral tramways in the North of England has proved the fact, that locomotive power may be used, in substitution for horse power with advantage on a narrower guage than that of four feet eight inches and a half. Messrs. Neilson, of Glasgow, have constructed a large number of such engines, many of them for lines of a guage of only two feet eight inches; and there is no doubt, that similar engines on a line of three feet guage will be equal to all the exigencies of a goods and passenger traffic short of that, which is sufficient to justify the construction of an ordinary First Class Railway. It is extremely probable that the chief value of the tractive power of Boydell's Locomotive, already referred to, in moving great weights, at a slow speed, and with a small expenditure of fuel, remains to be proved upon these narrow guage railways. Whatever its merits as a roadster may prove to be, it is certain that for every ton it draws on the high road, it will draw eight on the rail; and in cases where the goods traffic is heavy and the gradients steep, it may be found desirable and highly advantageous, so to construct the line, as to afford to the Locomotive with its broader guage, an even and solid roadway of its own, on the outside of the narrow three-foot Railway, for the effective application of its power as a Traction Engine, in the novel and ingenious manner designed by its inventor.

SPEED OF TRAINS.

Fifteen miles an hour for Passenger trains, and eight miles an hour for Goods trains, would be a speed easily and safely attainable, and doubtless sufficient for all the requirements of a First Class Tramway, worked by Locomotives; whilst on Second Class Tramways passengers might be carried by horses at an omnibus speed of nine or ten miles an hour, and goods at the rate of from three to four.

LAND.

That means should be devised for enabling the owners of these smaller lines, promoted and held, as they probably will be, by the principal landowners of the districts which they traverse, to obtain legal permanent possession of the land required for the purposes of the lines, without the necessity of actual purchase by payment, is extremely desirable. Whether this is provided for by conveyance upon a small nominal payment, with a permanent chief rent, or by assignment of rights of way-leave, it is apprehended that ampler legislative power than at present exists, will have to be provided for the purpose. And here we arrive at a still more important and interesting question.

If it be considered that a case has been made out in favour of the creation of a system of Secondary Railways, differing in many respects from those of the Main Lines, and that the extension of these facilities of communication into the rural districts, in the manner proposed, would be of public advantage, it may reasonably be demanded, that the means of obtaining legal sanction for their construction be rendered as simple and inexpensive as possible. Now the greatest impediment to progress in this direction that exists, is the necessity of obtaining for even the simplest tramway where tolls are levied, or land taken compulsorily, a *special* Act of Parliament for the purpose. The leverage afforded to the powers of extortion by this necessity, in addition to the inevitably heavy expenses attendant upon such an application to the Legislature, although unopposed, prohibits the hope, that, even were the restrictions referred to in the foregoing pages remitted to the full extent required, advantage would be taken largely of these increased opportunities, until the last and greatest obstacle to the development of this description of industrial enterprise—one which does not exist, and would not be tolerated in any other country in the world—be absolutely removed.

What is required, then, is a *general* Act of Parliament applicable to the whole of these Secondary Railways, authorizing the formation of simply organized companies or associations for their construction: consolidating and comprising within itself all the regulations and powers, which are usually prescribed and sought for in the *special* act ; fixing and appointing some inexpensive but authoritative tribunal, before which all questions of local reference and special character, such as the rates of carriage, the power of taking, and the mode of valuing land—or, rather, the right of way-leave and its price—shall be brought and determined ; and containing a clause enacting, that, whenever landowners possessing at least two-thirds of the total quantity of the land required for the construction of a proposed Tramway, shall present to the before-mentioned central authority a memorial in favour of the construction of such Tramway, the provisions of the act shall come into operation in respect to the district through which the Tramway is proposed to be carried.*

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* Similar powers have been granted to Drainage Commissioners in different parts of the country; and it is difficult to understand why the right to dam up the traffic, any more than the water, of a district, should be tolerated at the present day:—nor why rights of way-leave, and water-leave, should not be put on the same footing.

With reference to this suggestion I must again quote from the able and comprehensive Report on American Railways, already referred to. In describing the arrangements, under which railway companies in the United States are ordinarily incorporated, Captain Galton tells us, that :—

> "In a majority of States *general Railroad Laws* have been passed, enabling corporations to be formed for making Railways, the course of which is to be approved by *Railroad Commissioners, or by some executive authority,* due notice of the intended route being given in order that all persons interested may have an opoportunity to object. Very large discretionary powers are left with the commissioners as regards crossing roads, streets, rivers, &c."

In regard to the taking of land, we are told that :—

> " The mode of compensation varies in the different States. In some States the Courts appoint juries of twelve or of seven persons to determine the value. In other States a jury of twelve persons is named in the usual manner, from which each party alternately strikes off one until six are left. In other States the Court of the County names commissioners to make awards. The decisions are not in all cases final; an appeal may sometimes be carried into some Court of State.
>
> "In some States, as, for instance, in Ohio, the law provides that *the appraiser shall consider the probable benefit as well as the injury which the owner will sustain.*
>
> "The power to cross roads or streams of water is generally limited by the company being required, without unnecessary delay, to place such road or stream in a condition not to impair its former usefulness. Occupation roads must be provided when necessary."*

It cannot be denied, that we have, in the simple form of legislation here sketched out, a mode of dealing with these subordinate undertakings much better adapted to the requirements and necessities of the case, than the cumbrous and expensive machinery, by means of which legal existence has been conferred upon the Main Lines of the kingdom. Nor need we be at any loss for a fit and proper tribunal, in which to vest the discretionary powers above referred to: we have it, ready formed to our hands, in the Railway department of the Board of Trade, which, with its properly qualified officers, possesses precisely that amount of intelligence and authority necessary to constitute it a thoroughly efficient court of enquiry and judicature in all matters, which might thus be brought within its cognizance and jurisdiction.

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* Report to the Board of Trade by Captain Douglas Galton, R. E. pp. 7. 8.

COST.

If the nature of the country and the difficulties of construction in any selected district be such, that no line can be carried through it, in which the cost of the ordinary works of formation will not exceed considerably that of the upper works, or permanent way, such a district is not one in which the construction of even a Secondary Railway can be said to be financially practicable, unless, indeed, the nature and amount of the traffic be such as to fulfil the conditions of the axiom laid down at page 8.

Presuming, therefore, that the foregoing propositions are applicable only where these conditions are fulfilled, I estimate the cost of the construction of a First-Class Tramway, under favourable circumstances at £3,500 per mile; and of a Second-Class Tramway at £2,500 per mile. This estimate includes all contingent expenses except the cost of land, which it is proposed to convert into an annual payment for way-leave, and the cost of obtaining the right of construction, which, if the law be altered as suggested, ought to be inconsiderable.

An important question now remains to be considered :—

What are the circumstances in regard to traffic, which, on the above estimates of cost, would render the construction of either of these descriptions of Secondary Railway, as a commercial undertaking, justifiable.

If we adopt the same test as that which we applied to the case of a First-Class Branch Line of ordinary guage, the question will be speedily answered.

We will again take an imaginary line of ten miles in length, and assume the cost of its construction, if a First-Class Tramway, at £3,500; and if a Second-Class Tramway, at £2,500. Then if the earnings of the line be taken to be based upon an average rate of 2d. per mile for the conveyance as well of a Ton of goods, as of a single Passenger,* it will be seen, from the following calculations, that it will require a total number of 46,800 Tons and Passengers carried annually over the whole line, in the case of a First-Class Tramway, and a total number of 34,800 Tons and Passengers, in the case of a Second-Class Tramway, to produce a sum sufficient to pay 5 per cent. on the outlay, and working expenses. In estimating working expenses the sum in each case stated, has been carefully reckoned, and is considered to be an amount sufficient, under economical management, to provide for all the ordinary outgoings and working power. For the purpose of ready comparison, the three estimates of I. A First-Class Branch Railway of ordinary guage; II. A First-Class Tramway of three-foot guage; and III A Second-Class Tramway of three-foot guage are here given in succession:—

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* It will be observed that, in assuming these rates, no account is taken of mails, parcels, and terminal charges.

FIRST CLASS RAILWAY, GUAGE 4 ft. 8½ in.

Cr.		*Dr.*	
By Traffic.	£		£
Goods, 50,400 tons, carried 10 miles, @ 2d. per ton per mile	4,200	Interest on £70,000 @ 5 per cent. per annum	3,500
Passengers, 33,600 carried 10 miles, @ 2d. per mile	2,800	Working Expenses	3,500
Total, 84,000 @ 2d.	£7,000		£7,000

FIRST CLASS TRAMWAY, GUAGE 3 ft.

Cr.		*Dr.*	
By Traffic.	£		£
Goods 28,080 tons, carried 10 miles, @ 2d. per ton per mile	2,340	Interest on £35,000 at 5 per cent. per annum	1,750
Passengers, 18,720 carried 10 miles, @ 2d. per mile	1,560	Working Expenses	2,150
Total, 46,800 at 2d.	£3,900		£3,900

SECOND CLASS TRAMWAY. GUAGE 3 ft.

Cr.		*Dr.*	
By Traffic.	£		£
Goods, 20,880 tons, carried 10 miles, at 2d. per ton per mile	1,740	Interest on £2,500 at 5 per cent. per annum.	1,250
Passengers, 13,920 carried 10 miles, at 2d. per mile	1,160	Working Expenses.	1,650
Total, 34,800 at 2d.	£2,900		£2,900

It may be convenient, for the purpose of comparing these results with the tabular form, in which the actual proceeds of existing Railways are recorded in the weekly share-list, to reduce the annual amount, thus shewn to be the necessary revenue of these three descriptions of railways, to a weekly milage rate: or, in other words, to deduce from the above calculation the amount per mile per week, which each of them ought respectively to earn, in order to pay working expenses, and 5 per cent interest on the capital outlay, as follows:—

	Tons and Passengers.			Weeks.		£	s.	d.
1st Class Railway. . .	84,000	@ 2d.	÷	52	=	13	9	3
1st Class Tramway. .	46,800	@ 2d.	÷	52	=	7	10	0
2nd Class Tramway. .	34,800	@ 2d.	÷	52	=	5	11	6

In general terms, then, it may be stated, in answer to the foregoing question;

I. That, whenever the aggregate future annual traffic of any district, favourable to the construction of one of these tramways, can be safely estimated at 34,800 Tons and Passengers carried over the whole line, or the weekly earnings at £5 11s. 6d. per mile, the construction of a Second-Class Tramway is justifiable; II. That where this estimate reaches 46,800 Tons and Passengers per annum, or £7 10s. 0d. per mile per week, a First-Class Tramway is justifiable. III. That whenever this estimate reaches 84,000 Tons and Passengers per annum, or £13 9s. 3d. per mile per week, a First-Class Railway of ordinary guage may, under favourable circumstances be constructed.*

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* It does not follow from the above statement, that, whenever the Traffic on a First Class Tramway should reach 84,000 Tons and Passengers, it would be necessary or desirable to convert it into a First-Class Railway; it is calculated that a traffic of 400,000 Tons of Goods, and 300,000 Passengers may with ease and advantage, be carried annually by locomotive power over such a Tramway.

If this reasoning be correct, it would follow that all those lines of Railway, upon which, at present, the weekly earnings do not amount to £13 per mile, ought not to have been constructed with any expectation, that the shareholders would receive a reasonable rate of interest upon the outlay. Of the eighteen Railways, of which the weekly receipts, as reported in the share-lists, do not exceed £18, nine return absolutely no dividend to their proprietors; whilst of the remainder, three only are stated to return a dividend exceeding 2 per cent.* If to this list could be added that of all those branches and *feeders*, which have been constructed by, amalgamated with, or purchased by the larger companies—one, which would, I believe, be found far to exceed the former, both in its extent, and in the disastrous results which it would exhibit,—a remarkable and instructive picture would be presented of the ruinous effects of the wasteful and obstructive system of legislation, which has contributed so largely to the excessive cost of these works of public utility, and to the loss of their promoters.

The Question remains:—Is this prohibitive system to be maintained at all hazards?

Is accommodation to the districts unprovided for to be still denied except on terms which render it valueless? Are facilities, granted by the common sense of the American legislature, and the far-seeing sagacity of the Emperor of the French, as essential to the development of the internal resources of a land, to be any longer refused to the enterprise of this country ?* Or, on the other hand, is a door to be opened, by some such means as those suggested in the preceding pages, through which those districts, which have hitherto been shut out of the market, may find access to it ? Is a modified system of Railway extension to be permitted to grow up and flourish under the fostering care and protection of the department, over which your Lordship presides, calculated to carry to these remoter districts a portion of that prosperity, which has enriched the borders of the great thorough-fares, and in return to bring back the means of increased health and vigour to the parent system ? Is an opportunity for strengthening and renovating this vast national Railway system, created by an outlay of three hundred millions of British capital, contributed principally by the middle classes, and in the prosperity of which there are few individuals in the kingdom who are not directly or indirectly deeply interested, to be thus granted or not ?

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* In addition to the eighteen Railways above referred to, there are eight others which, earning more than £18 per mile per week, return no dividend to their proprietors.

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* The existence of Railways worked by horses on the Boulevards at Paris must be known to all who have of late years visited that city; and the adoption of similar horse Railways in many of the departments, for the secondary service of the smaller towns, and more remote districts, promises, from the encouragement given to these proposals by the government, and the municipal authorities, to become very general.

It may be a matter worth serious consideration whether a rapidly and cheaply constructed three-foot Tramway may not, for present urgent purposes, be the most advisable roadway to lay down in our colonies, rather than the more perfect, but infinitely more expensive and long-deferred locomotive Railway of ordinary guage.

These questions I respectfully submit to your Lordship's consideration, in the hope that they will not be found to be altogether undeserving your attention at a season when relief from the harass of Parliamentary debate permits the legislator to devote a few comparatively undisturbed moments, to questions of internal policy and social progress.

I am, my Lord,

Your Lordship's obedient Servant,

EDMUND SHARPE.

Lancaster, October 14th, 1857.

APPENDIX.

EXAMPLE.

Note A.—The suggestions contained in the preceding pages may be considered incomplete, unless accompanied by an illustration of their proposed application to a suitable district. With this view I have selected the valley of the River Conwy, in North Wales, as an example of a district fulfilling the required conditions, and well adapted, both from the nature of the country, and the amount of its traffic, to the introduction, in its upper and lower portions, of both these descriptions of Secondary Railway.

The Conwy Valley, or Vale of Llanrwst, as it is usually called, is a fine fertile valley, running at right angles to the direction of the Chester and Holyhead Railway at Conway. Its average breadth up to Llanrwst, a distance of eleven miles, is somewhat less than a mile; above Llanrwst the mountains begin to close in on each side, and at Bettws-y-coed, four miles higher, approach one another so nearly as to deprive the valley of the level character which it has, up to this point, uninterruptedly maintained. Here it is divided, receiving from the West the valley and stream of the Llugwy; from the South West the valley and stream of the Lledr; from the South the valley and stream of the Machno; and from the South East the diminished stream and valley of the Conwy; and the small towns and villages of Capel Curig, Dolwyddelan, Penmachno, and Pentre Voelas, standing respectively at the head of each of these four valleys, mark the limits of the natural traffic-shed of the district.

From the point where these vallies converge, a little above Bettws-y-Coed, to Conway, the total fall of the valley does not exceed eighty feet; and its general character is such as to present no engineering difficulties in the way of the construction of a railway of a simple and inexpensive character.

Under these circumstances it is not surprising that more than one attempt should have been made to form a company for the construction of a Railway from Conway to Llanrwst. In 1846 the valley was surveyed, and plans were subsequently prepared and deposited for an application to Parliament with this object. In 1853, a similar attempt was made in furtherance of a proposal to construct a Line on the East side of the river. In 1854 a third survey was made for a line on the West or Caernarvonshire side of the river, from Conway to Bettws-y-Coed; and lastly, in 1856 notice was given, and plans were deposited for a line on the opposite or Denbighshire side of the river, from a point on the Chester and Holyhead Railway near Conway to Llanrwst.

It is doubtless fortunate for the promoters of the whole of these schemes, that local unbelief in the sufficiency of the traffic of the district to render such an undertaking remunerative deprived them of that active assistance and pecuniary support on the part of the landowners and inhabitants of the valley, which was necessary to justify their proceeding beyond the threshold of the House of Commons; for it were hopeless to expect that this traffic, with even the considerable addition it would receive, were the Railway constructed, would for many years, reach that amount, which has been shewn, in the preceding pages, to be necessary to justify the construction of a Railway of this class.

The traffic of the valley consists of:—I That created by the requirements of a somewhat thinly-populated agricultural district of limited extent, including the small market town of Llanrwst: II That derived from certain slate quarries and mines, lying in the gullies and mountains to the South and West of the head of the valley: and III Of what may be called the Tourist traffic of the three summer months. The whole of this traffic, thus passing between Conway and Llanrwst, has been carefully noted during the last two years, and has been ascertained to be as follows:—

Goods	15,000	Tons.
Passengers	9,000	
	24,000	

Of the three sources of traffic above stated it may be said with reference to the first, that, although the ultimate effect of the construction of a Railway upon the population and requirements of the district would be considerable, the increase would not be immediate. With respect to the other two, the case is otherwise: there can be no doubt that the reduction of five shillings per ton in the cost of the carriage of slates and slabs would not only cause a great immediate increase in the production of the quarries already in existence, but would tend also to the opening of others in a country abounding in excellent veins of slate rock.

It is with particular reference to resources of this kind that the advantages arising from the adoption of the three-foot guage will be best understood. Were the guage of the Railway, 4 feet 8½ inches, lateral extension of it to the neighbouring quarries would be impracticable; all the produce would be sent down, either by cart, or in the common small quarry trucks, on a two-foot tramway, to the nearest siding, and there discharged and reloaded. Extensions of the three-foot Railway can, on the other hand, be carried up in a cheap form to the very heart of the quarry itself: and the trucks, loaded there, can be sent along this private tramway to the Branch Line, and passed down the whole length of the latter to its Terminus in the Main Line. Several of these extensions, or "Occupation" Tramways, are indicated on the Map which accompanies this Note, and which illustrates the character of the system proposed in the preceding pages, and its application to the particular district selected.